

REMARKS/ARGUMENTS

Favorable consideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-5, 7-9, 11-24, 27 and 28 are presently pending in this application, Claims 6, 10, 25 and 26 having been canceled and Claims 1, 2, 4 and 5 having been amended by the present amendment.

In the outstanding Office Action, Claims 1-28 were provisionally rejected under 35 U.S.C. § 101 as being identical to Claims 1-26 of co-pending application No. 10/387,452; Claims 1-2 were rejected under 35 U.S.C. 102(b) as being anticipated by Kawada et al. (U.S. Patent 5,665,260); Claims 3-6, 9, 10, 25 and 26 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kawada et al. in view of Miyata (U.S. Publication 2002/0027130); Claims 7 and 11 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kawada in view of Miyata and further in view of Noda et al. (U.S. Patent 5,753,893); Claims 8 and 12 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kawada in view of Miyata and further in view of Yamada et al. (U.S. Patent 5,998,320); Claims 13-16, 27 and 28 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kawada et al. in view of Miyata, and further in view of Ushikawa (U.S. Patent 6,140,256); Claims 3, 4 and 17-20 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kawada et al. in view of Kariya (U.S. Patent 6,452,137); and Claims 21-24 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kawada et al. in view of Miyata et al. and further in view of Natsuhara et al. (U.S. Patent 6,078,027).

The personal interview granted by Examiner Fastovsky, on January 8, 2004, is hereby gratefully acknowledged. In the course of this interview, possible claim amendments to overcome the cited prior art were discussed. The Examiner indicated that he would reconsider and further search if necessary.

The specification has been amended to correct typographical errors. No new matter has been introduced.

In response to the double-patenting rejection, Claims 6, 10, 25 and 26, which recite that the ceramic substrate has a disc shape, have been canceled. A corresponding amendment has been filed with co-pending application No. 10/387,452, which is a continuation application of the present application. The corresponding amendment amends claims of the continuation application No. 10/387,452 to recite that the ceramic substrate has a disc shape. Therefore, the double-patenting rejection is now moot.

Amended Claims 1, 2, 4 and 5 are fully supported by the specification, drawings and claims as originally filed. Applicants therefore submit that no new matter has been introduced.

Briefly recapitulating, Claim 1 is directed to a ceramic heater. For example, referring to the non-limiting embodiment of Figs. 1 and 2, a ceramic heater 10 includes a ceramic substrate 11 and a heating element 12. The ceramic substrate 11 has a work-heating surface which is configured to directly face a work to be heated. The heating element 12 is disposed either on or in the ceramic substrate 11. The work-heating surface has a JIS B 0601 surface roughness of $R_{max} = 0.05$ to $200 \mu\text{m}$.

According to the present invention recited in Claim 1, **the work-heating surface which is configured to directly face a work to be heated has a JIS B 0601 surface roughness of $R_{max} = 0.05$ to $200 \mu\text{m}$.**

The ceramic heater according to the present invention can heat the work placed on the work-heating surface or held apart from the work-heating surface. Since the surface roughness of the work-heating surface is adjusted within a specific range, the ceramic heater can heat the work to a substantially uniform temperature.

Referring to the attached Figs. 1B and 1D, if the surface roughness of the work-heating surface is too small, the area of contact between the work and the work-heating surface

becomes too large when the work is placed on the work-heating surface and heated. Therefore, the temperature difference in the ceramic substrate of the heater causes the temperature difference in the work (see Fig. 1B). Even when the work is held apart from the work-heating surface, the atmospheric gases (air, reactive gas, and the like) between the work and the work-heating surface flow easily and deprive the work of heat, so that the temperature difference is generated in the work (see Fig. 1D).

Referring to the attached Figs. 1A and 1C, if the surface roughness of the work-heating surface is too large, on the other hand, atmospheric gases remain at the space among the irregularities of the work-heating surface (valley) or at the space between the work and the work-heating surface. This causes accumulation of heat and leads to a large temperature difference of the work.

The effect of the present invention can be understood from the comparison of Examples and Comparative Examples. In Comparative Example 7, wherein R_{max} is $210\mu\text{m}$, the temperature difference of the work, that is, the difference between the highest and the lowest temperatures was as large as $8\text{ }^{\circ}\text{C}$. In Comparative Example 6, R_{max} is as small as $0.03\mu\text{m}$, but the difference between the highest and the lowest temperatures was also as large as $8\text{ }^{\circ}\text{C}$. On the other hand, in the corresponding Examples, the temperature difference of the work were small: in Example 8 ($R_{max} = 0.08\mu\text{m}$), the difference was $4\text{ }^{\circ}\text{C}$; in Example 9 ($R_{max} = 6\mu\text{m}$), it was $3\text{ }^{\circ}\text{C}$; in Example 10 ($R_{max} = 180\mu\text{m}$), it was $4\text{ }^{\circ}\text{C}$.

The Office Action asserts that Kawada et al. anticipate the present invention recited in Claim 1. However, Kawada et al. fail to disclose that the work-heating surface which is configured to directly face a work to be heated has a JIS B 0601 surface roughness of $R_{max} = 0.05$ to $200\mu\text{m}$. Instead, Kawada et al., referring to FIG. 1, disclose that the surfaces of a supporting substrate, electrodes and a heat generating layer have a roughness R_{max} of at least 5

μm .¹ The surfaces of the supporting substrate, the electrodes and the heat generating layer are not configured to directly face a work to be heated, and so are not the work-heating surface which is configured to directly face a work to be heated. In the Kawada et al. heater, the work-heating surface is the outer surface of a covering layer which is configured to directly face a work to be heated. Nowhere do Kawada et al. disclose or even suggest that the surface of a covering layer has a JIS B 0601 surface roughness of $R_{max} = 0.05$ to $200 \mu\text{m}$. Therefore, in the Kawada et al. heater, since the outer surface (the work-heating surface) of a covering layer does not have a JIS B 0601 surface roughness of $R_{max} = 0.05$ to $200 \mu\text{m}$, the Kawada et al. heater cannot heat the work such that the temperature of the work is to be substantially uniform.

Further, in the Kawada et al. reference, the purpose of the surface roughness of the surfaces of the supporting substrate, the electrodes and the heat generating layer is to prevent separation of the supporting substrate, the electrodes and the heat generating layer by the anchoring effect.² Because of this purpose, the outer surface of the covering layer does not necessarily have roughness.

Accordingly, Kawada et al. are not believed in any way to anticipate the specific features recited in Claim 1. Therefore, Claim 1 is believed to be allowable.

Substantially the same arguments as set forth above with regard to Claim 1 also apply to dependent Claims 3, 13, 17, 21 and 27, which depend directly from Claim 1. Accordingly, each of the dependent claims is also believed to be allowable.

Claim 2 is directed to a ceramic heater. The ceramic heater includes a ceramic substrate and a heating element. The ceramic substrate has a work-heating surface which is configured to directly face a work to be heated. The work-heating surface has a JIS B 0601 surface roughness of $R_{max} = 0.2$ to $200 \mu\text{m}$.

¹Kawada et al., col. 2, lines 50-53, col. 3, lines 36-51, col. 4, lines 31-36 and lines 57-62, and col. 5, lines 2-4, line 18 and line 31.

According to the present invention recited in Claim 2, the work-heating surface which is configured to directly face a work to be heated has a JIS B 0601 surface roughness of $R_{max} = 0.2$ to $200 \mu\text{m}$. Therefore, the ceramic heater according to the present invention can heat the work such that the temperature of the work is to be substantially uniform.

The Office Action asserts that Kawada et al. anticipate the present invention recited in Claim 2. However, Kawada et al. fail to disclose that the work-heating surface which is configured to directly face a work to be heated has a JIS B 0601 surface roughness of $R_{max} = 0.2$ to $200 \mu\text{m}$. Instead, Kawada et al., referring to FIG. 1, disclose that the surfaces of a supporting substrate, electrodes and a heat generating layer have a roughness R_{max} of at least $5 \mu\text{m}$.³ The surfaces of the supporting substrate, the electrodes and the heat generating layer are not configured to directly face a work to be heated, and so are not the work-heating surface which is configured to directly face a work to be heated. In the Kawada et al. heater, the work-heating surface is the outer surface of a covering layer which is configured to directly face a work to be heated. Nowhere do Kawada et al. disclose or even suggest that the surface of a covering layer has a JIS B 0601 surface roughness of $R_{max} = 0.2$ to $200 \mu\text{m}$. Therefore, in the Kawada et al. heater, since the outer surface (the work-heating surface) of a covering layer does not have a JIS B 0601 surface roughness of $R_{max} = 0.2$ to $200 \mu\text{m}$, the Kawada et al. heater cannot heat the work such that the temperature of the work is to be substantially uniform.

Further, in the Kawada et al. reference, the purpose of the surface roughness of the surfaces of the supporting substrate, the electrodes and the heat generating layer is to prevent separation of the supporting substrate, the electrodes and the heat generating layer by the anchoring effect.⁴ Because of this purpose, the outer surface of the covering layer does not

²Kawada et al., col. 2, lines 50-61.

³Kawada et al., col. 2, lines 50-53, col. 3, lines 36-51, col. 4, lines 31-36 and lines 57-62, and col. 5, lines 2-4, line 18 and line 31.

⁴Kawada et al., col. 2, lines 50-61.

necessarily have roughness.

Accordingly, Kawada et al. are not believed in any way to anticipate the specific features recited in Claim 2. Therefore, Claim 2 is believed to be allowable.

Substantially the same arguments as set forth above with regard to Claim 2 also apply to dependent Claims 9, 14, 18, 22 and 28, which depend directly from Claim 2. Accordingly, each of the dependent claims is also believed to be allowable.

Claims 4 and 5 are directed to a ceramic heater. The ceramic heater includes a nitride ceramic substrate and a heating element. The nitride ceramic substrate has a work-heating surface which is configured to directly face a work to be heated. The work-heating surface has a JIS B 0601 surface roughness of $R_{max} = 0.2$ to $200 \mu\text{m}$.

According to the present invention recited in Claims 4 and 5, the work-heating surface which is configured to directly face a work to be heated has a JIS B 0601 surface roughness of $R_{max} = 0.2$ to $200 \mu\text{m}$. Therefore, the ceramic heater according to the present invention can heat the work such that the temperature of the work is to be substantially uniform.

The Office Action asserts that Kawada et al. and Miyata obviate the present invention recited in Claims 4 and 5. Further, the Office Action asserts that Kawada et al. and Kariya obviate the present invention recited in Claim 4. However, none of Kawada et al., Miyata and Kariya disclose that the work-heating surface which is configured to directly face a work to be heated has a JIS B 0601 surface roughness of $R_{max} = 0.2$ to $200 \mu\text{m}$.

Since none of Kawada et al., Miyata and Kariya teach that the work-heating surface which is configured to directly face a work to be heated has a JIS B 0601 surface roughness of $R_{max} = 0.2$ to $200 \mu\text{m}$, even if the teachings of these references are combined, the combined teachings of these references would not in any way obviate the invention recited in Claims 4 and 5. Therefore, Claims 4 and 5 are believed to be allowable.

Substantially the same arguments as set forth above with regard to Claims 4 and 5 also

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apply to dependent Claims 7, 8, 15, 19 and 23, , which depend directly from Claim 4, and dependent Claims 11, 12, 16, 20 and 24, which depend directly from Claim 5. Accordingly, each of the dependent claims is also believed to be allowable.

Consequently, in view of the present amendment, it is respectfully submitted that this application is in condition for allowance and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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